ZOOLOGY.

The New England species of Balanoglossus.—In 1873, Alex. Agassiz described a Tornaria from New England which he ascribed to the common Balanoglossus of the region. Bateson later, studying in Virginia and North Carolina, showed that in *B. kowalevskii* there is a direct development. The question at once arose, what form did Agassiz have? Either his Tornaria did not belong to *B. kowalevskii* or the same species has a different development in different regions. Now Prof. T. H. Morgan announces[1] that he has found Bateson's larvæ with the *Balanoglossus kowalevskii* on the southern coast of New England. This clears up one problem but it still leaves the origin of the Tornaria questionable.

Marsipobranchs.—Beard reports[2] that in young Myxines in which the pronephros was functional, the teeth were present in several rows upon the roof of the mouth. Apparently there is no Ammocete stage, but there is a metamorphosis. He further finds that at least in one specimen of a male Petromyzon in about one section in forty of the testis there was a well marked ovum, occupying a follicle for itself.

The Lateral Line of Siluroids.—Pollard has been tracing the cephalic divisions of the lateral line system in several Siluroids[3] and while his work is largely descriptive and admits of no abstract, one is struck with the support he brings to the old view of Huxley that the Arthrodira are near relatives of the Siluroids and especially to the close affinities of Clarias and Coccosteus. The parallels in the canals of the two forms are very exact. On the other hand Pollard points out a close resemblance between the African genera Clarias and Auchenaspis and the South American, Chætostomus. The facts remains, that while careful studies of the lateral line like these of Pollard may in future throw much light upon the phylogeny of various groups of fish-like forms, we have as yet not data enough for much generalization.

Prodromus of a new System of the non-venomous Snakes.—The unsatisfactory character of the existing classifications of the

[1] Zool. Anz. XV, 456, 1892.
[2] Anat. Anz. VIII, p. 59, 1892.
[3] Zoolog. Jahrbüches, VI, 1892.

non-venomous snakes is well known. That authors are not agreed as to the principles on which these animals should be classified may be learned by comparison of the systems published by Duméril and Bibron in 1853, Günther in 1858, myself in 1886 (Proceeds. Amer. Philos. Society), and Boulenger in 1892 (Reptilia of Zoology of British India). It had appeared evident to me that a further examination of the anatomy of these reptiles is necessary before a correct account of their mutual relations can be given, and that the organs of the reproductive system especially, were likely to yield important results. With the object of obtaining light on this question, I have made an examination of the hemipenis, and have obtained valuable indications of relationship which have been hitherto unknown. I have had the opportunity of examining material from the collections of the Academy of Philadelphia, of the U. S. National Museum, and of my own cabinet. I present here a general synopsis of the results, reserving for a future occasion the publication of a fuller illustrated memoir on the subject. The resulting classification is more in harmony with the systematic indications obtained from the study of other vertebrata, than those hitherto adopted, which is itself an indication of its greater approximation to nature. Some points remain obscure, and many details are omitted from the present prodromus.

The hemipenis of the Ophidia is traversed by a groove which divides the muscular investment to the internal integument (or external integument when the organ is retracted), which commences at the base internally, and soon turns to the external side of the organ and continues to its extremity. This is the sulcus spermaticus. This sulcus is always bifurcated in venomous snakes, and I find it to be equally bifurcated in many harmless snakes. The investing tissues may or may not correspond with this bifurcation. Thus the hemipenis may be more or less bifurcate. Schlegel states that it is bifurcate in venomous snakes, but it is not so in *Hydrophis hardwickii*, *Bungarus semifasciatus*, *Hoplocephalus coronatus*, etc., while it is bifurcate in many non-venomous forms. Next to the bifurcation of the sulcus in importance, is the nature of the surface of the external investment (internal when retracted). In the most perfect types both venomous and non-venomous, this surface is reticulate like tripe, the enclosed areas forming calyces, which may have a suctorial function. Their borders are generally papillose, and are sometimes so deeply divided into papillæ as to lose their original character. These papillæ may be the seat of osseous deposit, becoming bristles or spines, which become larger toward the middle of the length, and lose their mutual membranous connections. These isolated spines

may extend to the apex, but they rarely extend to the base. The surface may, however, be laminate and not recticulate, and the laminæ may be longitudinal or transverse. In either of these cases they may not be spiniferous. The apex or apices of the organ may be furnished with a rigid papilla or awn. The entire surface of the organ when protruded, is designed for the maintainance of its position in the oviduct of the female, from which it cannot be withdrawn, excepting by invagination.

In the Tortricina and Peropoda, the hemipenis is not spinous, and the sulcus is bifurcate, and in the Boidae the hemipenis is bifurcate also, although in some genera (Xiphosoma, Ungualia), the branches are very short. The external integument is never reticulate, but is always laminate with elongate papillæ at the extremities, in Epicrates, Xiphosoma, and Ungualia. The laminae are pinnate from the sulcus as an axis, in Morelia, Enygrus, Lichanura and Eryx, and are transverse in Charina. In Ilysia they are pinnate, with a few longitudinal plicæ below.

The general definitions of the families exclusive of the Peropoda are as follows.

No spines; surface longitudinally plicate; *Calamariidæ.*

The surface of the hemipenis is flounced more or less transversely; *Lycodontidæ.*

The surface is more or less reticulate, and the sulcus spermaticus is undivided; hypapophyses anterior; *Colubridæ.*

The surface is reticulate or longitudinally plicate, and the sulcus is divided; hypapophyses anterior; *Xenodontidæ.*

The surface is neither reticulate nor flounced, and the spines when present are disconnected; hypapophyses continued to caudal vertebræ; *Natricidæ.*

The Calamariidæ approach in the characters of the hemipenis to such Peropoda as Eryx. The character assigned to the Lycodontidæ is more or less distinctly present in the typical or Solenoglyph venomous snakes; while the Najidæ (exclusive of Elapidæ) on the other hand, cannot be distinguished from the Xenodontidæ, by any general character. The Lycodontidæ are Old World with a single genus in America; a distribution resembling that of the Pythonidæ. The Colubridæ inhabit the Old World and North America, a few genera entering South America. The distribution is like that of the firmisternial Salientia. The Xenodontidæ are of South America and Madagascar, a few genera entering Africa and North America, a distribution nearly like that of the Iguanian lizards. The Natricidæ are distributed in the Northern Continents, very few types occurring in Africa and none in South America.

It will be observed that all of the families include burrowing types, and that the Colubridæ and Xenodontidæ include also arboreal types. This result is in accordance with the general rule that adaptations to present environment are not indications of the deepest affinities. All the families include glyphodont genera. The genera included in these families are the following:

CALAMARIIDÆ.

In *Calamaria gervaisii* the plicæ are well developed. Species formerly referred to Simotes belong here. In *Holarchus*[4] (Cope) *ancorus*, the sulcus is undivided, and the distal part of the external side is membranous. In the *H. trinotatus* the sulcus and hemipenis are shortly bifurcate, for which reason I refer it to a distant genus under the name of Dicraulax. I have had access to very few types of this group, and consider the present arrangement provisional.

LYCODONTIDÆ.

I. Aglyphodont; sulcus spermaticus undivided.

No palatine or pterygoid teeth. (In *Oligodon subquadratus* the only species of the genus examined, there are two robust papillæ on the extremity of the hemipenis); *Oligodontinæ.*

Hemipenis simple; palatine and pterygoid teeth; *Lycodontinæ.*

II. Aglyphodont; sulcus spermaticus, and generally hemipenis, bifurcate; *Boodontinæ.*

III. Glyphodont; sulcus and hemipenis bifurcate; *Cantoriinæ.*

IV. Glyphodont; sulcus simple; *Uriechinæ.*

To the Lycodontinæ belong Lycodon and Anoplophallus (=Megalops Hallow.) which has a long loreal and no preocular plate, and no spines on the hemipenis. To the Boödontinæ belong Boödon and Lamprophis; to the Uriechinæ, Uriëchis and the sole American genus, Stenorhina. The typical genus of each of the other subfamilies are the only ones I have been able to examine. The Oligodontinæ may belong to the Calamariidæ.

COLUBRIDÆ.

The subfamilies are as follows:

Aglyphodont; hemipenis reticulate; *Colubrinæ.*

Glyphodont; reticulate; *Dipsadinæ.*

Glyphodont; longitudinally laminate; *Chrysopeleinæ.*

The COLUBRINÆ are either burrowing (fusiform), terrestrial (colubriform), or arboreal (attenuate), and are so grouped for convenience.

[4] Bulletin, U. S. Natl. Museum, 32, 1887, p. 54.

Fusiform. Chilomeniscus; Ficimia; Geagras; Cemophora; Rhinochilus; Conopsis (has papillæ at the apex in addition to a few cups).; Stylosoma (spinous nearly to apex.)

Colubriform. Contia; Hypsiglena (pocketed below apex); Proterodon; Dianodon; Coronella; Ophibolus; Rhinechis; Phyllorhynchus (four rows of spines dividing calyculate apex); Salvadora; Symphimus; Epiglottophis; Pityophis; Spilotes; Coluber; Bascanium; Drymobius; Zamenis; Ptyas; Herpetodryas; Cyclophis; Liopeltis; Cynophis (has a terminal papilla which is produced into an awn); Crossanthera, (g. n.) established for *Deudrophidium melanotropis* Cope, on account of the total division of the walls of the small cups into papillæ.)

Attenuate. Dendrophis; Leptophis; Bucephalus; Dasypeltis (papillæ spinous to apex.)

In the DIPSADINÆ the same gradation appears.

Fusiform. Tantilla; Scolecophis; Ogmius (spines to apex).

Dipsadiform; (generally pocketed below apex). Sibon; Trimorphodon; Crotaphopeltis; Himantodes; Rhinobothryum; Dipsas.

Attenuate. Cladophis; Oxybelis; Dryophis (has a diverticulum simulating a bifurcation of the hemipenis); Tragops; Passerita.

The CHRYSOPELEINÆ includes only the genus Chrysopelea, so far as I have examined.

Genera of Colubridæ in which the calyces are not papillose, are Phyllorhynchus, Hypsiglena, Dianodon, Proterodon, Coronella, Symphimus, Dendrophis, Crotaphopeltis and Dipsas.

XENODONTIDÆ.

The arrangement of the genera of this family is difficult, and what is presented here is only tentative. It seems probable that some genera with a grooved posterior tooth are more nearly allied to others with a smooth tooth than to each other; but on the other hand the external form of the animal is a poor guide, as all forms pass into each other. So also the reticulate or plicate character of the integument of the hemipenis. Many of the genera may be distinguished by details of structure. As before, I designate the general forms as fusiform, colubriform, attenuate, and dipsadiform; and for the present I adopt two subfamilies.

Aglyphodont; *Xenodontinæ.*

Glyphodont; *Scytalinæ.*

XENODONTINÆ.

Fusiform. Catostoma; Carphophiops; Farancia*†; Pseudoeryx; Ninia.

Colubriform. Homalosoma†; Grayia; Theleus g. n.; Diadophis; Rhadinæa; Pliocercus; Opheomorphus*; Liophis*; Dromicus; Alsophis; Lianthera g. n.; Hypsirhynchus*; Amastridium; Helicops; Xenodon*; Acanthophallus†; Lystrophis*; Heterodon.

Attenuate. Uromacer.

Dipsadiform. Leptognathus†, Mesopeltis†.

The genera of this subfamily in which the surface is exclusively longitudinally plicate are marked with a star; on the other genera it is more or less reticulate. The genera in which the extremity is spinous are marked with a †. In Theleus the hemipenis is simple, and its apex is covered with short separate papillæ, below which it is coarsely spinous; type *Boodon virgatum* Hallow. from W. Africa. Lianthera is established on *Herpetodryas bernieri* of Madagascar, and related species, on account of the absence of calyculi, and weak development of spines of the hemipenis, and the isodont dentition. The genus Acanthophallus is designed to include the species formerly referred to Xenodon in which the hemipenis is spinous to the extremity. The type is *X. colubrinus* Gthr; the anal plate is entire. In Xenodon the extremity is smooth and plicate, and the anal plate is divided.

SCYTALINÆ.

Fusiform. Hydrocalamus.†

Colubriform. Pseudophis; Erythrolamprus*; Tachymenis†; Coniophanes; Conophis; Rhinostoma; Scytale; Oxyrrhopus; Tomodon†; Thamnodynastes (includes *Tachymenis hypoconia* M.), Tropidodryas; Philodryas; Jaltris.*

Attenuate. Langaha.

As in the Xenodontinæ, genera with the apex plicate only are marked with a star, and those with a spinous apex are marked with a dagger. The only species of Tomodon I have examined is the *T. ocellatus*, which is not the type. The position of Langaha I am not satisfied about, as it may be an attenuate form of the Natricidæ.

NATRICIDÆ.

This family, which I first defined from vertebral characters, is generally easily distinguished from the others by the characters of its hemipenis. This organ is never reticulate, and the spines are always small or rudimental. When present they originate in fossæ of the integument and are never connected by tegumentary folds, except when they sometimes stand on longitudinal plicæ. The aglyphodont genera (except the Pseudaspidinæ) make up for the deficiency of the spines, by the presence of one or two large hooks on one side of the sulcus spermaticus at the base. The sulcus is variable, being sometimes simple, and sometimes bifurcate. The subfamilies are as follows:

¶Glyphodont.	Spines better developed; no basal hook;	*Homalopsinæ.*
¶Aglyphodont.	Spines rudimental; no basal hook;	*Pseudaspidinæ.*
¶Aglyphodont.	Spines rudimental; a basal hook.	*Natricinæ.*

Of the HOMALOPSINÆ only the genera Homalopsis, Herpeton, and Cerberus have come under my observation; but I suppose that Hypsirhina and other allied Asiatic genera will be found to present the same characters. In both genera the sulcus is bifurcate, and the hemipenis divided.

I have been able to examine but one genus of the PSEUDASPIDINÆ, viz., Pseudaspis Cope (type *Coronella cana* L.), but I suspect that Ablabes (*A. rufulus*) which is African, belongs here. In Pseudaspis the sulcus is bifurcate, and the hemipenis is divided almost to the base, quite as in the most specialized Solenoglypha.

NATRICINÆ.

This natural group includes fusiform and colubriform genera, and presents great variations in the form of the hemipenis. The Asiatic species have that organ bifurcate, while in the European and American water snakes it is simple.

Fusiform. (Hemipenis simple). Haldea; Tropidoclonium (the apex with a pair of robust papillæ as in Oligodon;) Virginia.

Colubriform. I. Sulcus and hemipenis undivided. Storeria; Eutænia; Natrix; Clonophis; Liodytes. II. Sulcus and hemipenis divided. Diplophallus, g. n. (type *Tropidonatus piscator* Schneid.; has syncranterian dentition, and no apical papilla); Amphiesma; Ceratophallus (established on *Tropidonotus vittatus* on account of the presence of a rigid papilla on the apex of each branch of the hemipenis.)

Similar gradations in the characters of the hemipenis are to be seen in the types of venomous snakes. Thus in the Proteroglypha this organ is spinous to the tip, on a calyculate basis, in Hydrophis, Elaps, (*surinamensis*); Dendraspis. It is reticulate at the extremities and spinous below, in Callophis (*bivirgatus*); Naja; Acanthophis; Bungarus and Sepedon; the apex smooth in the two genera last named. In *Elaps nigrocinctus* the organ is usually smooth, with a few spines at the apex.

In Solenoglypha the genus Atractaspis is spinous to the apex, apparently on a longitudinally laminate basis. In the Viperidæ and Crotalidæ the spines are on a flounced basis. The apices are calyculate in Bitis, Clotho, and Vipera, and spinous in Cerastes. They are calyculate in Crotalidæ in Bothrops, Ancistrodon, Crotalophorus, Crotalus and Uropsophus. In Crotalus (*durissus* of the Neotropical fauna), the median spines are replaced by papillæ, in all the other genera they are spinous.—E. D. COPE.

Zoological News. PROTOZOA.—Prof. August Gruber, in a note on nuclear multiplication and swarm formation in the Freshwater Rhizopoda[5] describes an Arcella in which milotic cell division occurred. He also figures Arcella with 19 and 32 nuclei, and *Lecythium hyalinum* with eightnuclei. These facts are adduced in evidence that among the fresh-water Rhizopods reproduction by spore formation coexists along with simple fission. In other cases Gruber found small bodies in Arcella tests which at first sight might be taken for swarm spores but which are none other than parasitic Amoebæ.

WORMS.—Nachtrieb and Barrows are studying the leeches in Minnesota. In a preliminary note[6] Mr. Barrow states that they have found 11 species of Gnathobdellidæ, 10 of Rhynchobdellidæ and 1 of Branchiobdellidæ. It is noted that two species of Aulostoma can be distinguished by the fact that in the one the right sperm duct passes under the nerve cord; in the other the left. A final report is promised.

Henry B. Ward reports[7] the host of *Nectonema agile*.[8] Dr. McMurrich found a worm, like Nectonema except that it lacked the lateral bands of setæ, characteristic of the adult, in the thoracic cavity of Palæmonetes. This when studied by Dr. Ward, proved to be a female Nectonema.

MOLLUSCA.—H. Suter enumerates 142 species of land molluscs, 32 fluviatile, and 18 brackish water species, in New Zealand.

According to C. Hedley, *Parmacochlea fischerii* collected by the "Challenger" expedition is most nearly allied to Helicarion.

[5] Ber. Naturf. Gesellsch. Freiburg, VI, 114, 1892.

[6] Quarterly Bulletin, Univ. Minnesota I, p. 87, 1893.

[7] Proc. Amer. Acad. Arts and Sci. 1893, p. 260.

[8] See AMER. NAT. XXVI, 1037, 1892.